

1    WHAT IS CLAIMED IS:

1.    An electron-emitting device comprising  
a pair of oppositely disposed electrodes and an  
electroconductive film arranged between the electrodes  
5    and including a high resistance region, characterized  
in that the high resistance region has a deposit  
containing carbon as a principal ingredient.

2.    An electron-emitting device according to  
10    claim 1, wherein said deposit containing carbon as a  
principal ingredient is also present in the vicinity  
of said high resistance region.

3.    An electron-emitting device according to  
15    claim 2, wherein said deposit containing carbon as a  
principal ingredient is present on said electroconductive  
film from part of said high resistance region.

4.    An electron-emitting device according to  
20    claim 3, wherein said deposit containing carbon as a  
principal ingredient is present particularly on one of  
said electrodes from said high resistance region.

5.    An electron-emitting device according to  
25    claim 4, wherein said deposit containing carbon as a  
principal ingredient is present particularly on part  
of the electroconductive film close to the higher

1 potential one of said electrodes from said high  
resistance region.

6. An electron-emitting device according to  
5 claim 1, wherein said electroconductive film is made  
of electroconductive fine particles.

7. An electron-emitting device according to  
claim 6, wherein said electroconductive fine particles  
10 are made of metal or an oxide of metal.

8. An electron-emitting device according to  
claim 6, wherein at least part of said electroconductive  
fine particles are coated with said deposit.

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9. An electron-emitting device according to  
claim 1, wherein said high resistance region contains  
electroconductive fine particles.

20 10. An electron-emitting device according to  
claim 9, wherein at least part of said electroconductive  
fine particles are coated with said deposit.

11. An electron-emitting device according to  
25 claim 1, wherein at least part of said electrodes are  
coated with said deposit containing carbon as a  
principal ingredient.

1           12. An electron-emitting device according  
to claim 1, wherein said deposit containing carbon as  
a principal ingredient is principally made of graphite,  
amorphous carbon or a mixture thereof.

5           13. An electron-emitting device according to  
claim 1, wherein the electron emission current of the  
device has a monotonically increasing characteristic  
relative to the voltage applied to said electrodes.

10           14. An electron source comprising an electron-  
emitting device for emitting electrons according to  
input signals, characterized in that said electron-  
emitting device is a device according to one of claims  
15   1 through 13.

          15. An electron source according to claim 14,  
wherein it comprises a plurality of said electron-  
emitting devices arranged in a plurality of rows, each  
20   of said electron-emitting devices being connected to  
wirings at opposite ends, and a modulation means for  
modulating electron beams emitted from said electron-  
emitting devices.

25           16. An electron source according to claim 14,  
wherein it comprises a plurality of said electron-  
emitting devices arranged in rows and respectively

1 connected to m X-directional wirings and n Y-directional  
wirings that are mutually electrically insulated.

17. An image-forming apparatus comprising an  
5 electron source and an image-forming member for forming  
images according to input signals characterized in that  
said electron source comprises an electron-emitting  
device according to one of claims 1 through 13.

10 18. An image-forming apparatus according to  
claim 17, wherein said electron source comprises a  
plurality of said electron-emitting devices arranged  
in a plurality of rows, each of said electron-  
emitting devices being connected to wirings at opposite  
15 ends, and a modulation means for modulating electron  
beams emitted from said electron-emitting devices.

19. An image-forming apparatus according to  
claim 17, wherein said electron source comprises a  
20 plurality of said electron-emitting devices arranged  
in rows and respectively connected to m X-directional  
wirings and n Y-directional wirings that are mutually  
electrically insulated.

25 20. An image-forming apparatus according to  
claim 17, wherein the emission current and the device  
current of said electron source have a monotonically

1 increasing characteristic relative to the voltage  
applied to said devices.

21. An image-forming apparatus according to  
5 claim 17, wherein the inside of said image-forming  
apparatus is maintained to a degree of vacuum that  
does not allow any additional deposition to be made  
to said deposit containing carbon as a principal  
ingredient.

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22. A method of manufacturing an electron-  
emitting device comprising a pair of oppositely disposed  
electrodes and an electroconductive film arranged  
between the electrodes, characterized in that it  
15 comprises a device activation process.

23. A method of manufacturing an electron-  
emitting device according to claim 22, wherein said  
activation process is a process for depositing a deposit  
20 containing carbon as a principal ingredient on said  
electroconductive film.

24. A method of manufacturing an electron-  
emitting device according to claim 23, wherein said  
25 activation process comprises a step of applying a  
voltage to the electroconductive film arranged  
between the electrodes in vacuum.

1           25. A method of manufacturing an electron-emitting device according to claim 24, wherein said voltage is applied in the form of pulse.

5           26. A method of manufacturing an electron-emitting device according to claim 25, wherein said voltage is above a voltage-controlled-negative-resistance level.

10          27. A method of manufacturing an electron-emitting device according to claim 26, wherein said voltage is a drive voltage for driving the electron-emitting devices.

15          28. A method of manufacturing an electron-emitting device according to claim 23, wherein said activation process comprises a step of applying a voltage to the electroconductive film arranged between the electrodes in an atmosphere containing an introduced  
20 carbon compound.

          29. A method of manufacturing an electron-emitting device according to claim 28, wherein said voltage is applied in the form of pulse.

25          30. A method of manufacturing an electron-emitting device according to claim 29, wherein said

1 voltage is above a voltage-controlled-negative-  
resistance level.

5 31. A method of manufacturing an electron-  
emitting device according to claim 30, wherein said  
voltage is a drive voltage for driving the electron-  
emitting devices.

10 32. A method of manufacturing an electron-  
emitting device according to claim 28, wherein said  
carbon compound is an organic gas.

15 33. Method of manufacturing an electron-  
emitting device according to claim 32, wherein said  
organic gas has a vapor pressure of not higher than  
5,000hPa at the temperature and in the atmosphere of  
the activation process.

20 34. A method of manufacturing an electron-  
emitting device according to claim 33, wherein said  
organic gas has a vapor pressure of not higher than  
5,000hPa at 20°C.

25 35. A method of manufacturing an electron-  
emitting device according to claim 32, wherein said  
organic gas has a vapor pressure between 0.2hPa and  
5,000hPa at the temperature and in the atmosphere of

1 the activation process.

36. A method of manufacturing an electron-  
emitting device according to claim 35, wherein said  
5 organic gas has a vapor pressure between 0.2hPa and  
5,000hPa at 20°C.

37. A method of manufacturing an electron-  
emitting device according to claim 22, wherein it  
10 further comprises a forming process.

38. A method of manufacturing an electron-  
emitting device according to claim 37, wherein said  
forming process is a step of forming a high resistance  
15 region in the electronconductive film arranged between  
the electrodes.

39. A method of manufacturing an electron-  
emitting device according to claim 22, wherein said  
20 activation process is carried out after said forming  
process.

40. An electron source comprising an electron-  
emitting device for emitting electrons according to  
25 input signals, characterized in that said electron-  
emitting device is manufactured by a method according  
to one of claims 22 through 39.



1           41. An electron source according to claim 40,  
wherein it comprises a plurality of said electron-  
emitting devices arranged in a plurality of rows, each  
of said electron-emitting devices being connected to  
5 wirings at opposite ends, and a modulation means for  
modulating electron beams emitted from said electron-  
emitting devices.

          42. An electron source according to claim 40,  
10 wherein it comprises a plurality of said electron-  
emitting devices arranged in rows and respectively  
connected to m X-directional wirings and n Y-  
directional wirings that are mutually electrically  
insulated.

15           43. An image-forming apparatus comprising an  
electron source and an image-forming member for  
forming images according to input signals characterized  
in that said electron source comprises an electron-  
20 emitting device manufactured by a method according to  
one of claims 22 through 39.

          44. An image-forming apparatus according to  
claim 43, wherein said electron source comprises a  
25 plurality of said electron-emitting devices arranged  
in a plurality of rows, each of said electron-emitting  
devices being connected to wirings at opposite ends,

1     and a modulation means for modulating electron beams  
emitted from said electron-emitting devices.

45.   An image-forming apparatus according to  
5     claim 43, wherein said electron source comprises a  
plurality of said electron-emitting devices arranged  
in rows and respectively connected to m X-directional  
wirings and n Y-directional wirings that are mutually  
electrically insulated.

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46.   An image-forming apparatus according to  
claim 43, wherein the emission current and the device  
current of said electron source have a monotonically  
increasing characteristic relative to the voltage  
15     applied to said devices.

47.   An image-forming apparatus according to  
claim 43, wherein the inside of said image-forming  
apparatus is maintained to a degree of vacuum that  
20     does not allow any additional deposition to be made  
to said deposit containing carbon as a principal  
ingredient.

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